DEPARTMENT OF ENVIRONMENTAL PROTECTION
NEW JERSEY GEOLOGICAL SURVEY

Prepared in cooperation with the
U. S. GEOLOGICAL SURVEY
NATIONAL GEOLOGIC MAPPING PROGRAM

SURFICIAL GEOLOGY OF THE YONKERS AND NYACK QUADRANGLES
BERGEN COUNTY, NEW JERSEY
OPEN-FILE MAP OFM 50

Appendix of well and boring logs accompanies map

INTRODUCTION

Surficial deposits in the Yonkers and Nyack quadrangles include artificial fill and alluvial, swamp, estuarine, eolian, and stream-terrace deposits, all of postglacial age; glaciolacustrine deposits of late Wisconsinan and, possibly, Illinoian, age; and till of late Wisconsinan and possible Illinoian age. The glaciolacustrine deposits include stratified sand, gravel, silt, and clay and are as much as 150 feet thick. Till is as much as 80 feet thick. Postglacial deposits are generally less than 20 feet thick, except beneath the Hudson River, where estuarine deposits may be as much as 200 feet thick.

The accompanying map and sections show the surface extent and subsurface relations of these deposits. Their composition and thickness, and the glacial and postglacial events they record, are described in the "Description of Map Units." Well and boring data used to construct bedrock-surface contours and to infer the subsurface distribution of the deposits are provided in Appendix 1 (in pamphlet). The composition of pebbles in the glacial sediments is shown in table 1. The chronologic relationships of the deposits are shown in the "Correlation of Map Units." Aquifer properties of the deposits are briefly described below.

AQUIFER PROPERTIES

Surficial deposits in the quadrangle yield ground water to several public-supply wells and influence the movement of water and pollutants from the land surface into lakes, streams, and underlying bedrock and glacial aquifers. Glacial aquifers are tapped by wells at several places. Yields and screened intervals for these wells are provided in Appendix 1. In Englewood, several industrial wells (15, 16, 18) drawing water from lacustrine-fan and gravel (unit Qhkf) yield as much as 300 gallons per minute. Similar deposits are tapped by public-supply wells adjacent to Oradell Reservoir (100, 101, 104). In both cases, these deposits are confined by overlying silt and clay (unit Qhkl).

Hydraulic conductivities of the surficial deposits can be estimated from statewide glacial aquifer-test data on file at the N. J. Geological Survey (online at www.state.nj.us/dep/njgs/geodata) and published aquifer-test and laboratory data summarized by Stanford and Witte (in press). Sand and gravel deposits (units Qhkf, Qhdf, part of Qtn). The stratified sediments also include silt, clay, and fine sand deposited on the bottoms of glacial lakes (Qhdl, Qhkl, Qtnl) and moderately to poorly sorted sand and gravel deposited in ice-walled basins and ponds (Qsp, Qic). All of these deposits are of late Wisconsinan age except for units Qb and Qsp, which may be of Illinoian age.

The orientation of striations and drumlins indicates that late Wisconsinan ice advanced southward to southeasterward across the map area. This ice was part of an advancing lobe channeled between the Palisades ridge to the east and Carnegaw and Ramapo mountains to the west (Salisbury, 1902; Stanford and Harper, 1991). During advance the landsurface was shaped by glacial erosion. In most of the quadrangle, older glacial deposits (units Qb, Qsp) were stripped off and the underlying sandstone bedrock was eroded into streamlined forms. The more resistant diabase bedrock of the Palisades was smoothed and streamlined on the west slope of the ridge and plucked on the east slope to create or accentuate prominent cliffs. In valley bottoms, bedrock was scoured below modern sea level, more than 50 feet below in the Hackensack Valley, 100 feet below in the Overpeck and Sparkill valleys, and 300 feet below in the Hudson Valley. While the general location of valleys and uplands likely corresponds to their preglacial location, all bedrock topography below modern sea level in the Overpeck and Sparkill valleys, and below about -200 feet in the Hudson Valley, is glacially overdeepened and does not reflect preglacial drainage. In a few places the earlier glacial deposits (units Qb and Qsp) and weathered sandstone and diabase bedrock, were not completely eroded and are preserved beneath the late Wisconsinan till.

Till was deposited over almost all of the bedrock surface except on the ridgetop and cliffs of the Palisades. It is as much as 80 feet thick but generally is 20 to 30 feet thick. It is thin or absent on valley bottoms, either because it was never deposited there or because it was later eroded by subglacial meltwater. The late Wisconsinan till includes three varieties: a yellowish-brown to gray silty sand till (Netcong till, Qn, occurs only in the extreme northwest corner of the map) derived from the gneiss bedrock of the Hudson Highlands, just north of the quadrangle; a reddish-brown silty sand to sandy silt till (Rahway till, Qr) derived from the local red sandstone and conglomerate bedrock; and a reddish-yellow to yellow sandy silt to silty till (Rahway till, yellow phase, Qryr) derived from the local weathered diabase.

Late Wisconsinan ice advanced to a southernmost position at Perth Amboy, about 30 miles south of the map area. The ice front began to retreat from this position before 20,000 yrs B. P., and had likely retreated north of the map area by 18,000 yrs B. P. (Stanford and Harper, 1991). The retreating ice margin maintained a lobate form, its apex centered on the Hackensack Valley, on the west edge of the map area (fig. 1). Recessional ice-margin positions are marked by ice-contact deltas deposited in glacial lakes Teaneck, Tenakill, and Hackensack, and by ice-contact deposits in the Hackensack and Tenakill valleys (fig. 1).

Lakes Hackensack and Hudson were large proglacial lakes that occupied the Hackensack and Hudson valleys, respectively (fig. 1). Lake Hackensack drained eastward into Lake Hudson when Sparkill Gap, a low point in the Palisades Ridge, was uncovered by the retreating ice margin (fig. 1). Lake Hudson persisted until the moraine dam at the Narrows between Brooklyn and Staten Island was breached, long after ice had retreated from the region.

Lakes Tenakill and Teaneck were smaller, local proglacial lakes. Lake Tenakill occupied the north-draining Tenakill Valley, which was dammed by the head of the Englewood delta (fig. 1). When the north end of the bedrock ridge west of Closter was uncovered by the retreating ice margin, Lake Tenakill lowered about 15 to 20 feet and became contiguous with Lake Hackensack. Lake Teaneck occupied the headwaters of the north-draining Hirshfeld Brook Valley (fig. 1) An early, high stage of the lake was controlled by a spillway leading to the south; a later, lower stage was controlled by a spillway leading to the east. Both drained into Lake Hackensack (fig. 1). The lake drained when the north end of the ridge on the west side of the valley was deglaciated.

Glacial-Lake Deposits--These are stratified and generally well-sorted. They include sand and gravel laid down in deltas and lacustrine fans, and clay, silt, and fine sand laid down on lake-bottom plains and in the basal parts of deltas. Bedding in the deltas includes inclined foreset beds of sand, pebbly sand, and minor pebble-to-cobble gravel, overlain at the surface of some deltas by horizontal topset beds of sand and pebble-to-cobble gravel. Lacustrine fans contain gently dipping beds of sand and pebble-to-cobble gravel. Bedding in both deltas and fans may be deformed locally by collapse, slumping, or shoving by glacial ice. Bedding in lake-bottom deposits is generally horizontal, laminated to thin-bedded, and undeformed. Nongravel sediment is light reddish brown, reddish brown, and light gray. Sand is chiefly quartz, feldspar, mica, and fragments of gray and red-brown sandstone and mudstone, gray gneiss, and gray quartzite. Gravel is chiefly white-to-gray gneiss, gray mudstone and sandstone, and reddish-brown sandstone; and some black chert, white quartz, white-to-gray quartzite, and yellow-to-gray carbonate rock.

GLACIAL LAKE HACKENSACK DEPOSITS--Deltaic, lake-bottom, andlacustrine-fan deposits laid down in glacial Lake Hackensack. Lake level in the map area, as marked by delta-front and delta-top landforms, rises from an elevation of about 35-40 feet at Englewood to about 60-65 feet at Tappan and Sparkill (Stanford and Harper, 1991).

Qhk Deltaic deposits--Pebbly sand, sand, and pebble-to-cobble gravel. As much as 80 feet thick.

Qhkl Lake-bottom deposits--Silt, clay, fine sand. As much as 120 feet thick.

Qhkf Lacustrine-fan deposits--Pebble-to-cobble gravel and sand. As much as 80 feet thick.

GLACIAL LAKE HUDSON DEPOSITS--Lake-bottom and lacustrine-fan deposits laid down in glacial Lake Hudson. Lake level in the map area, inferred by projecting levels recorded by delta landforms to the north and spillway elevations to the south, rises from 5-10 feet at the south edge of the map area to 30-35 feet at the state line. Deposits are inferred from borings and geophysical surveys north and south of the map area (Worzel and Drake, 1959; Newman and others, 1969; Stanford, 1993). They are not exposed or penetrated by borings in the map area.

Qhdl Lake-bottom deposits--Silt, clay, fine sand. Probably no more than 50 feet thick.

Qhdf Lacustrine-fan deposits--Sand and gravel (unit Qhkf) yield as much as 300 gallons per minute. Similar deposits are tapped by public-supply wells adjacent to Oradell Reservoir (100, 101, 104). In both cases, these deposits are confined by overlying silt and clay (unit Qhkl).

GLACIAL LAKE TENAKILL DEPOSITS--Deltaic, lacustrine-fan, and lake-bottom deposits laid down in glacial Lake Tenakill. The lake level was controlled by a spillway at an elevation of 55-60 feet at the head of the Englewood delta.

Qtn Deltaic and lacustrine-fan deposits--Fine-to-coarse sand and pebble-to-cobble gravel. As much as 90 feet thick.

Qtnl Lake-bottom deposits--Fine sand, silt, and clay. As much as 80 feet thick.

GLACIAL LAKE TEANECK DEPOSITS--Deltaic deposits laid down in two stages of glacial Lake Teaneck. The higher, earlier stage (Qtk1) was controlled by a spillway in Tappan Gap (about 0.5 mile west of the ridge along Route 4) (Stanford, 1994). The lower, later stage (Qtk2) was controlled by a spillway at an altitude of 80 feet in Bergenfield.

Qtk1 Deltaic deposits--Fine-to-coarse sand, some pebble-to-cobble gravel. As much as 20 feet thick (estimated).

Qtk2 Deltaic deposits--Fine-to-coarse sand, some pebble-to-cobble gravel. As much as 30 feet thick.

Qsp PRE-ADVANCE STRATIFIED DEPOSITS--Sand, clay, and gravel. As much as 50 feet thick. In subsurface only, beneath late Wisconsinan till. Occur chiefly where the bedrock surface slopes northward, suggesting that they may be lacustrine sediments laid down in ice-dammed proglacial ponds. They may be Illinoian recessional deposits, or advance-phase late Wisconsinan deposits overrun by the advancing late Wisconsinan ice.

Qic ICE-CONTACT DEPOSITS--Pebble-to-cobble gravel and sand, locally cobble-to-boulder gravel and sandy, cobbly diamicton; moderately sorted, variably stratified. As much as 80 feet thick. Form hummocky ridges or benches above the level of adjacent lakes or fluvial plains. They may have been deposited in ice-walled basins or by glacial shoving of previously deposited sediment.

Till--Poorly sorted, nonstratified sediment deposited directly by glacial ice or by sediment flows from glacial ice. Sediment is matrix-supported and is generally compact below the soil zone due to consolidation by the weight of overlying ice. The matrix may show a coarse subhorizontal platy structure. Four tills are distinguished on the basis of color, grain-size, and age. Rahway till is in gradational contact with Rahway till, yellow phase; and the mapped area of each on the Palisades Ridge may contain small unmapped inclusions of the other.

Qn NETCONG TILL--Yellow, yellowish-brown, reddish-yellow, very pale brown (oxidized) to grayish- brown and brown (unoxidized) silty sand to sandy silt with many (10-40% by volume) subrounded to subangular pebbles and cobbles, and few (less than 5%) to some (5-10%) boulders. Depth of oxidation ranges from 10 to about 50 feet. Till matrix is generally compact, nonplastic, nonsticky, nonjointed, and may have subhorizontal fissility. As much as 20 feet thick. Gravel is chiefly gray-to-white gneiss and gray mudstone and sandstone, with a little red sandstone and white-to-gray quartz and quartzite. Boulders are chiefly gneiss, with a very few quartzite and gray and red sandstone. Clast composition reflects southerly glacial transport from the Wallkill and Hudson valleys, which are underlain by Paleozoic sedimentary rock, and the Hudson Highlands, which is underlain by Proterozoic gneiss.

Qr RAHWAY TILL--Reddish-brown, light reddish-brown, reddish-yellow silty sand to sandy silt containing some to many subrounded and subangular pebbles and cobbles and few subrounded boulders. Matrix is compact, nonsticky, nonplastic to slightly plastic, nonjointed, and may show a coarse subhorizontal fissile structure. Gravel clasts include chiefly red and gray sandstone and siltstone, and gray gneiss, and a little white-to-gray quartz and quartzite. Boulders are chiefly gneiss, also very sparse quartzite and gray and red sandstone. As much as 80 feet thick. Unit Qrt delineates areas where Qr is discontinuous and generally less than 10 feet thick.

Qry RAHWAY TILL, YELLOW PHASE--Reddish-yellow, yellow, light gray sandy silt to silt containing few to some subrounded and subangular pebbles and cobbles and few subrounded boulders. Matrix is compact, slightly sticky and plastic, nonjointed, and may show a coarse subhorizontal fissile structure. Gravel and boulder composition similar to unit Qr, except that diabase is common. As much as 30 feet thick. Unit Qryt delineates areas where Qry is discontinuous and generally less than 10 feet thick.

Qb BERGEN TILL--Reddish-brown to reddish-yellow sandy clayey silt to sandy clay. Gravel and boulder content and composition similar to Rahway till. Matrix is compact, moderately sticky and plastic, and weakly jointed. Gneiss, sandstone, and mudstone clasts may have weathering rinds or be decomposed. As much as 10 feet thick. Observed in four outcrops; these are indicated by a special symbol on the map. Of pre-Wisconsinan (possible Illinoian) age.

MAP SYMBOLS

Contact--Dashed where approximate, gradational, or feather-edged; dotted where concealed by water.

Drumlin--Line along crest, symbol on summit.

Striation--Observation at dot. Flagged data from Salisbury and Peet (1895).

Meltwater channel--Line in base of channel, arrow indicates flow direction. Dashed where uncertain.

Spillway for glacial lake--Symbol in spillway area, arrow indicates direction of drainage.

47 ● **Well with log in Appendix 1**--Location accurate within 100 feet.

74 ○ **Well with log in Appendix 1**--Location accurate within 500 feet.

4 ▲ **Site of pebble lithology count**--Data in table 1.

150 **Elevation of bedrock surface**--Contour interval 50 feet.

△ 60 **Elevation of bedrock surface**--In well or boring, data from Lovegreen, 1974.

⊠ 30 **Elevation of bedrock surface**--In well or boring, data from files of the N. J. Geological Survey.

Bedrock outcrop--Many small outcrops within units Qrt and Qryt not shown.

Former bedrock outcrop--Shown on manuscript field maps (circa 1900) on file at the N. J Geological Survey, but no longer exposed.

Well on sections--Projected to line of section.

Shallow topographic basin--Line on rim, pattern in basin. Of probable periglacial origin, developed in sandy stream terrace deposits underlain by lake-bottom silt and clay. Those containing significant organic sediment are mapped as unit Qs.

12,840±110 (WISS-1482) **Radiocarbon date**--In years before present. Laboratory number in parentheses. Details and references in text.

Qb **Outcrop of unit Qb**--Observed in 1987.

(Qal) **Unit formerly present**--Former extent of alluvium beneath Oradell Reservoir, now removed or disturbed by excavation.

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Table 1.--Composition of pebbles in surficial deposits

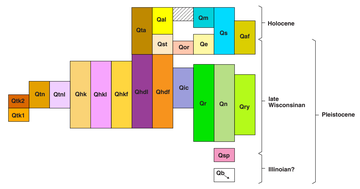
Site	Unit	Number of pebbles	Percentage of pebbles						
			gneiss	gray sandstone and mudstone	red sandstone	quartz[1]	quartzite[2]	carbonate rock[3]	chert	diabase
1	Qhk	125	6	8	80	3	3			
2	Qhk	155	30	52	9	4	5			
3	Qic	164	19	18	61	1	1			
4	Qic	165	38	49	7		6			
5	Qic	138	36	41	11	2	8	2		
6	Qic	256	23	31	36	4	6			
7	Qhk	155	29	25	42	1	3			
8	Qic	129	31	26	36	2	5			
9	Qic	149	37	20	38	1	4			
10	Qr	120	11	39	48	2				
11	Qry	99		28	49	4			1	18
12	Qr	129	6	38	51	3	2			
13	Qry	126	4	9	38	14	10		2	23

[1]Includes white rounded quartz pebbles from a preglacial fluvial deposit that formerly covered the Hudson Valley (Pennsauken Formation). Some quartz pebbles may also have weathered out from local conglomerate bedrock of the Newark Basin.

[2]Includes white and gray quartzite and quartzite-conglomerate from Paleozoic bedrock in the Hudson-Wallkill Valleys.

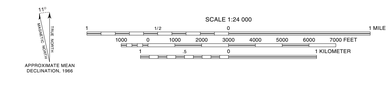
[3]Includes mostly weathered dolomite and limestone from Paleozoic bedrock in the Hudson-Wallkill Valleys.

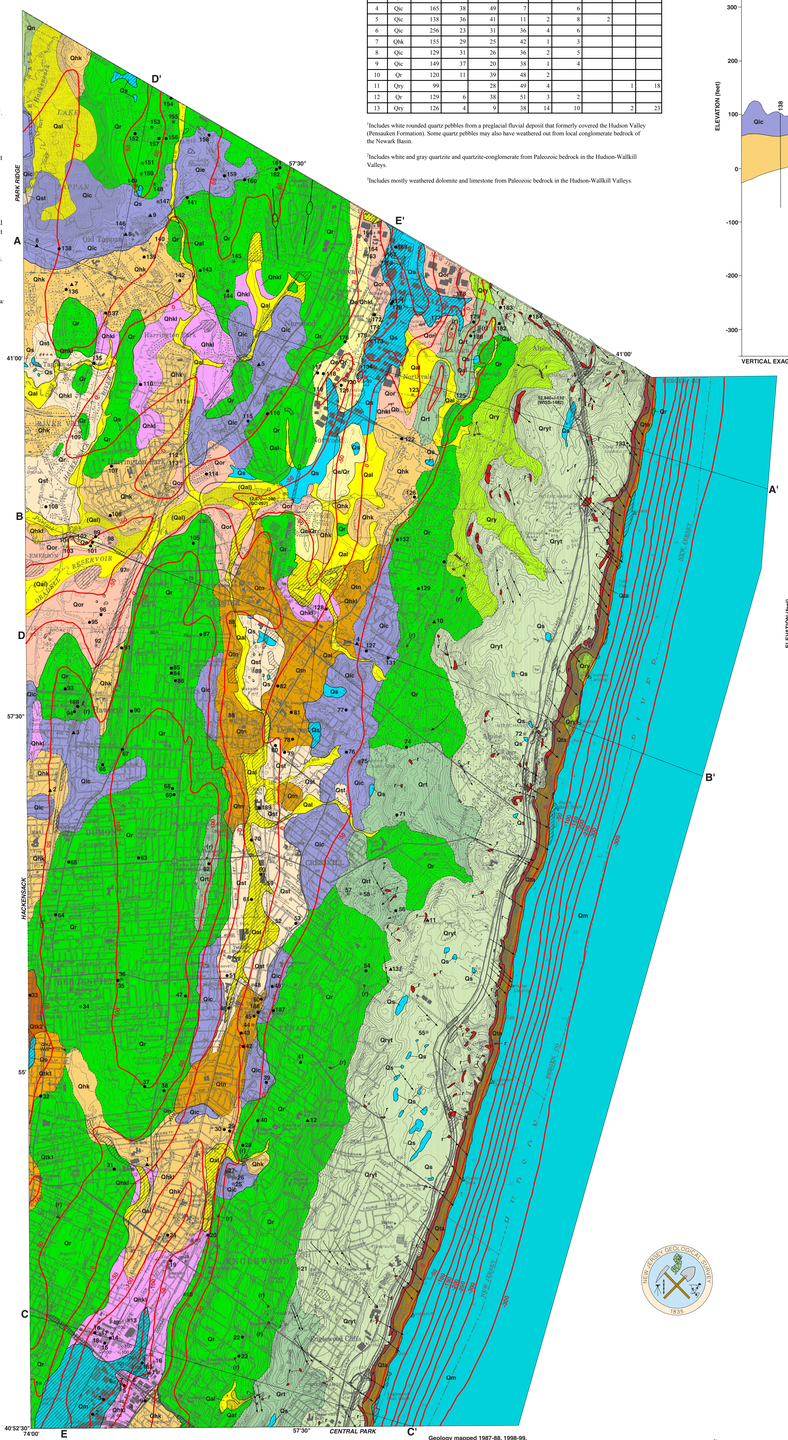
CORRELATION OF MAP UNITS

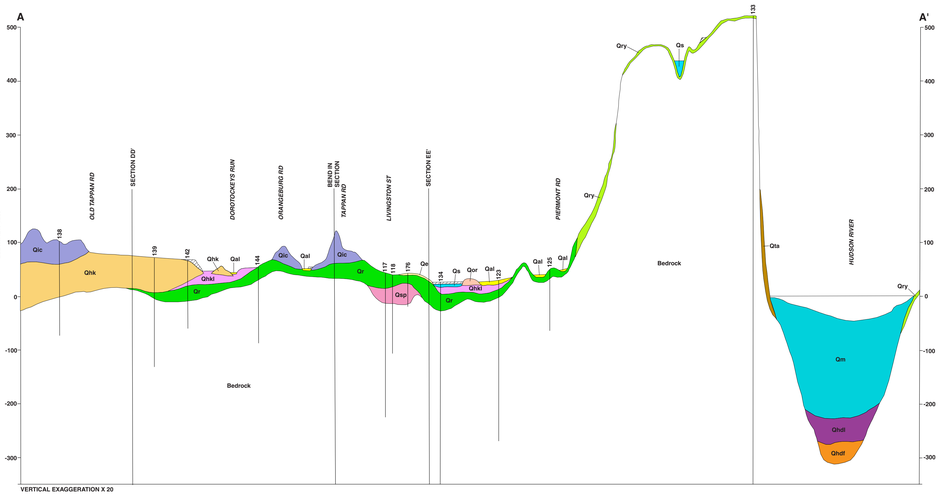


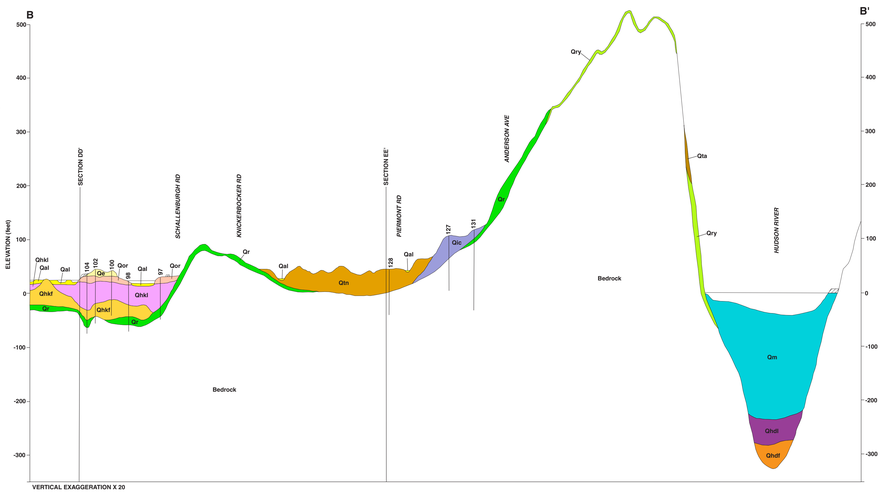
SURFICIAL GEOLOGY OF THE YONKERS AND NYACK QUADRANGLES, BERGEN COUNTY, NEW JERSEY

by
Scott D. Stanford
2002









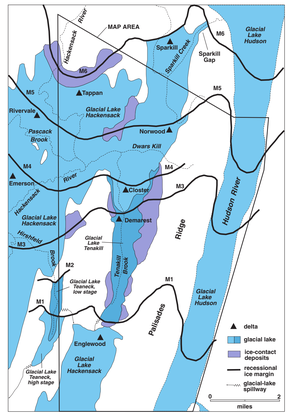
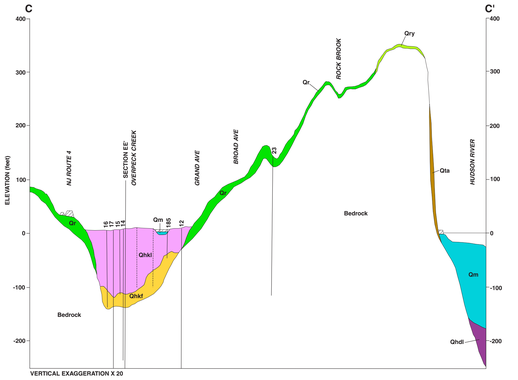
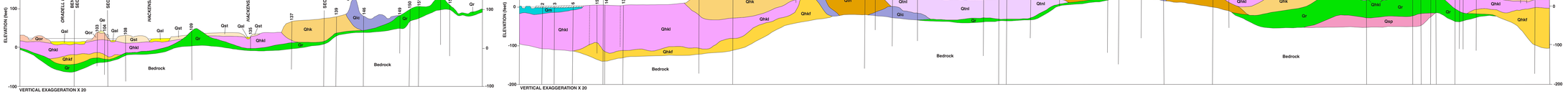


Figure 1.--Recessional ice margins and glacial lakes, showing location of deltas and spillways. Ice margins are: M1=last margin before high stage of Lake Teaneck dropped to the low stage. Delta deposited in Lake Hackensack at Englewood. M2=last margin before before Lake Teaneck drained. M3=delta deposited in Lake Tenakill at Demarest. M4=last margin before Lake Tenakill lowered to Lake Hackensack. Deltas deposited in Lake Tenakill at Closter and in Lake Hackensack at Emerson. M5=deltas deposited in Lake Hackensack at Riverside and Norwood. M6=last ice margin before Lake Hackensack drained through Sparkill Gap into Lake Hudson. Deltas deposited at Old Tappan and Sparkill, New York.





Surficial Geology of the Yonkers and Nyack Quadrangles, Bergen County, New Jersey

New Jersey Geological Survey
Open-File Map 50
2002

text to accompany map

Appendix 1.--Selected Well and Boring Logs

Well No.	Identifier[1]	Driller's Log	
		Depth[2]	Description[3]
1	26-6059	0-8	dirt (Qr)
		8-250	red shale
2	26-828	0-4	fill
		4-19	black muck (Qm)
		19-47	gray clay (Qhkl)
		47-68	red clay (Qhkl)
		68-71	red hard sand (Qr)
		71-180	sandstone in all colors
		180-200	trap
3	26-2237	0-98	gray clay (Qm over Qhkl)
		98-115	red hardpan (Qr)
		115-298	soft red rock
4	26-4066	0-47	clay (Qhkl)
		47-57	red hardpan (Qr)
		57-300	red rock
5	26-4421	0-20	sand (Qhkl or Qal)
		20-120	clay (Qhkl)
		120-324	red rock
6	26-4422	0-20	sand (Qhkl or Qal)
		20-120	clay (Qhkl)
		120-450	red rock
7	26-810	log by Frank Markewicz, NJGS, abbreviated here	
		0-10	light pinkish gray, very fine-to-fine sand (Qhkl or Qal)
		10-70	light pinkish gray to pale red clayey silt (Qhkl)
		70-83	pale red silt with pebbles (Qr)
		83-99	pale red clayey silt and angular red shale fragments (Qr)
		99-380	pale red sandstone
		380-410	gray argillite and sandstone
		410-470	light gray sandstone and trap fragments
8	26-4328	0-20	sand (Qhkl or Qal)

		20-120	clay (Qhkl)
		120-356	red rock
9	26-5434	0-4	sand, gravel, cinder fill
		4-23	brown and red-brown coarse-to-fine sand, some coarse-to-fine gravel, trace silt, clay, cobbles (Qhk)
10	26-461	0-20	clay (Qhkl)
		20-55	hardpan (Qr)
		55-250	red shale
		250-400	sand rock
		400-410	trap
11	26-2781	0-46	muck with clay (Qm over Qhkl)
		46-396	red rock
12	26-4357	0-8	backfill overburden
		8-35	clay (Qhkl)
		35-370	sandstone and trap
13	26-791	0-5	brown sand and clay (Qhkl or Qal)
		5-11	gray sand and clay (Qhkl or Qal)
		11-22	brown sand, clay, quick sand (Qhkl or Qal)
		22-32	gray clay (Qhkl)
		32-42	gray and red clay, mixed (Qhkl)
		42-64	gray clay (Qhkl)
		64-126	reddish brown clay (Qhkl)
		126-135	hardpan (Qr)
		135-354	sandstone
14	26-6111	0-5	sandy soil (Qal or fill)
		5-20	yellow sandy clay (Qhkl)
		20-80	fine sandy gray clay (Qhkl)
		80-120	gray clay (Qhkl)
		120-145	fine silty sand (Qhkf)
		145-146	gravel (Qhkf)
		146-242	sandstone
15	26-7000	0-3	fill
		3-62	gray clay (Qhkl)
		62-96	red sticky clay with fine sand (Qhkl)
		96-112	fine silty sand (Qhkf)
		112-121	sand and gravel (Qhkf)
		at 121	red shale
		screened 100-112, yield 300 gpm	
16	26-2742	0-110	gray clay (Qhkl)
		110-145	sand and gravel (Qhkf)
		screened 135-145, yield 150 gpm	
17	26-2427	0-130	NR (probably clay, Qhkl)
		130-140	sand (Qhkf)
		140-380	shale
18	26-6142	0-110	clay (Qhkl)
		110-155	fine sand (Qhkf)
		155-300	red rock
		screened 145-155, yield 70 gpm	

19	26-7359	0-2	fill--sand, brick, concrete
		2-5	brown clay, trace sand (Qhkl)
		5-13	brown medium-to-fine sand, trace silt (Qhkl)
		13-18	brown silty sand (Qhkl)
		18-20	brown silt (Qhkl)
20	26-6901	abbreviated log	
		0-19	red-brown medium-to-fine sand, some silt, little gravel (Qhkl or Qal)
21	26-3519	0-20	gravel overburden, red clay (Qr)
		20-345	trap rock
22	26-3430	0-18	overburden (Qr)
		18-570	trap rock
23	26-4043	0-18	overburden (Qr)
		18-265	trap rock
24	26-4716	0-5	cinders, soil
		5-60	brown and red sand (Qhk)
		60-120	red sand (Qhk over Qhkl)
		120-140	red sand and clay (Qhkl)
		140-142	red gravel (Qhkf or Qr)
		142-151	red sand (Qhkf or Qr)
		151-202	red shale
25	26-2436	0-5	fill
		5-30	sand (Qic)
		30-300	sandstone
26	26-4489	0-22	hardpan (Qic)
		22-300	red rock
27	26-4217	0-50	red shale
		50-230	sandstone
28	26-5079	0-21	red sand, gravel, clay (Qr)
		21-200	red rock
29	26-785	0-76	glacial fill (Qhk over Qr)
		76-158	red rock
30	26-6040	0-4	orange silt, clay, fine sand (fill)
		4-15	red silt, sand, trace clay, cobbles (Qhk)
		15-32	red fine, medium, coarse sand, little silt (Qhk)
		32-50	red silty fine sand (Qhkl)
31	26-3429	0-20	overburden with boulders (Qr)
		20-161	red rock
32	26-6675	0-4	fill--sand, gravel, silt, cobbles
		4-16	red brown coarse-to-fine sand and coarse-to-fine gravel, little silt, occasional cobbles (Qr)
33	26-4752	0-5	fill
		5-20	sand (Qtk2)
		20-25	gravel with some water (Qtk2)
		25-70	red shale

34	26-3853	0-27	sand and gravel (Qr)
		27-200	sandstone and shale ledges
35	26-3271	0-15	hardpan (Qr)
		15-198	shale
36	26-145	0-20	sand and gravel (Qr)
		20-200	red rock
37	26-3730	0-20	unconsolidated overburden (Qr)
		20-25	soft red shale
		25-230	red sandstone
38	26-3491	0-24	red overburden (Qr)
		24-96	red rock
39	26-3898	0-47	red sand, clay, and gravel (Qic)
		47-96	white and purple sandstone
40	26-3691	0-21	coarse sand and gravel (Qr)
		21-210	trap rock
		210-235	red or pink trap rock
41	26-1357	0-29	yellow hardpan (Qr)
		29-176	conglomerate
		176-180	dark gray trap rock
42	26-1798	0-52	silty sand (Qtn)
		52-202	red rock
43	26-1615	0-19	sand and dirt (Qtn)
		19-100	sand rock
44	26-4394	0-16	sand and gravel (Qtn)
		16-28	red hardpan (Qr)
		28-107	red sandstone
45	26-2787	0-38	sand and gravel (Qtn)
		38-107	red sandstone
46	26-4103	0-40	sandy clay (Qtnl)
		40-73	dry sand and gravel (Qtn or Qic)
		73-145	red sandstone
47	26-3825	0-12	sand (Qr)
		12-38	shale
		38-125	red rock and sandstone mixed
48	26-663	0-37	clay--sand and clay and clay and gravel matrix (Qtnl over Qr?)
		37-50	brown stone
49	26-1169	0-10	dirt and boulders (Qic)
		10-20	sand and gravel (Qic)
		20-75	red rock
50	26-6679	0-9	fill--sand, gravel, cobbles, boulders
		9-16	gray and red-brown silt, trace fine sand, trace clay (Qtn)
51	26-533	0-74	sand and silt, water and coarse sand at top of rock (Qtnl over Qic)

		74-125	red sandstone
52	26-11742	0-3	fill
		3-20	brown medium-to-fine sand (Qtnl)
53	26-4336	0-10	overburden fill
		10-25	clay, gray (Qtnl)
		25-30	clay, reddish gray (Qtnl)
		30-165	trap rock, some reddish fine sandstone
54	26-3492	0-10	overburden (Qr)
		10-97	trap rock
55	26-5817	0-8	hardpan and boulders (Qry)
		8-740	granitic rock (diabase)
		740-1000	
	red shale		
56	23-8340	0-15	sandy soil (Qr)
		15-243	trap rock
		243-367	red shale
57	23-8314	0-40	sand, clay (Qr)
		40-800	trap rock
58	23-463	0-4	sand (fill or Qr)
		4-31	hardpan (Qr)
		31-68	sandstone
59	23-2348	0-72	sand and clay (Qtnl)
		72-276	sandstone
60	23-2273	0-72	sand and clay (Qtnl)
		72-279	sandstone
61	23-5056	0-10	sand fill
		10-30	marsh clay (Qal over Qtnl)
		30-60	fine sand (Qtnl)
		60-76	hardpan (Qr)
		76-164	red sandstone
62	23-4388	0-21	red hardpan (Qr)
		21-185	red rock
63	23-4533	0-21	overburden (Qr)
		21-170	red sandstone
64	23-7583	abbreviated log	
		0-14	red-brown medium-to-fine sand, some medium-to-fine gravel, cobbles, and boulders, little to some silt (Qr)
		at 14	shale
65	23-4657	0-16	unconsolidated overburden, red sandy clay (Qr)
		16-150	red sandstone
66	23-7108	0-12	red hardpan (Qr)
		12-114	red sandstone
67	23-7404	abbreviated log	

		0-34	reddish brown very fine sand, little silt, little gravel and boulders (Qr)
		34-50	shale
68	23-7190	0-30	red stony hardpan (Qr)
		30-150	red shale
69	23-7174	0-30	red stony hardpan (Qr)
		30-159	red shale
70	23-8956	0-83	sand and gravel (Qtnl over Qtn)
		83-85	hardpan (Qr)
		85-118	sandstone
71	23-4597	0-3	soil (Qr)
		3-93	badly fissured sandstone
		93-200	red rock
72	23-4232	0-10	clay, gravel (Qry)
		10-670	trap rock
73	23-7743	0-3	overburden (Qry)
		3-1085	granite (diabase)
74	23-6889	0-40	clay and sand (Qr)
		40-200	shale and sandstone
75	23-4637	0-24	sand, gravel (Qic)
		24-110	white rock
		110-137	trap
76	23-4424	0-34	sand and gravel (Qic)
		34-150	red and white sandstone
77	23-5397	0-3	clay (fill)
		3-65	sand and gravel (Qic)
		65-69	red clay (Qr)
		69-160	red sandstone
78	23-4596	0-3	soil (Qtn)
		3-15	shale (maybe Qtnl)
		15-125	brown sandstone
		125-200	red rock
79	23-4801	0-10	unconsolidated clay overburden (Qst over Qtnl)
		10-30	clay hardpan (Qr)
		30-165	red sandstone
80	23-6344	0-50	clay, red shale (Qst over Qtnl)
		50-167	red rock
81	23-4259	0-35	hardpan (Qtn)
		35-45	sand (Qtn)
		45-150	red rock
82	23-7586	0-15	sand and fine gravel (Qtn)
		15-28	coarse sand and pea gravel (Qtn)
		28-170	red sandstone

83	BWA files	0-8	coarse gravel and sand (Qtn)
	23-44-536	8-93	fine sand with some water (Qtn)
		93-101	stony hardpan (Qr)
		101-142	red shale
84	23-1139	0-26	stony hardpan (Qr)
		26-106	red sandstone
85	23-1138	0-26	stony hardpan (Qr)
		26-109	red sandstone
86	23-1117	0-35	red hardpan (Qr)
		35-106	red sandstone
87	23-6255	0-18	hardpan (Qr)
		18-150	red rock
88	23-556	0-5	black loam (Qal)
		5-11	stony hardpan (Qal)
		11-47	fine sand (Qtnl)
		47-56	hardpan (Qr)
89	23-7279	0-72	sand (Qtnl over Qtn)
		72-76	red hardpan (Qr)
		76-90	red shale
		90-160	brown fine sandstone
		160-386	brown shale
90	23-6475	0-40	stony hardpan (Qr)
		40-90	red sandstone
91	23-4570	0-17	hardpan (Qr)
		17-125	red rock
92	23-4876	0-8	clay and hardpan (Qor)
		8-20	sandy clay (Qhkl)
		20-41	hardpan (Qr)
		41-200	red sandstone
93	23-5631	0-3	backfill
		3-5	sand, red (Qr)
		5-16	clay, red (Qr)
		16-185	red sandstone
94	23-4409	0-30	sandy clay (Qr)
		30-185	sandstone and red shale
95	23-499	0-5	clay (fill or Qor)
		5-44	sand and gravel (Qor over Qhk)
		44-100	red rock
96	23-8200	0-4	fill
		4-20	sandy soil (Qor)
		20-44	red hardpan (Qhkl over Qr)
		44-150	red sandstone
97	23-1302	abbreviated log	
		0-11	brown sand and gravel (Qor)
		11-45	gray to brown clay (Qhkl)

		45-54	brown sandy clay (Qhkl)
		54-72	sand, large gravel, clay, no water (Qr)
		72-75	red rock
98	23-1184	0-8	fine sand (Qor)
		8-29	gray clay (Qhkl)
		29-45	brown clay (Qhkl)
		45-48	sand and gravel with clay (Qhkf)
		48-54	coarse sand and gravel (Qhkf)
		54-63	hardpan (Qr or Qhkf)
		63-66	sand and gravel with clay (Qr or Qhkf)
		66-84	hardpan (Qr)
		84-88	brown sandstone
		88-95	red shale
99	23-1981	0-6	grayish brown clay (Qor or fill)
		6-7	coarse sand and gravel (Qor)
		7-24	gray clay (Qhkl)
		24-45	red clay (Qhkl)
		45-65	brown clay (Qhkl)
		65-85	red hardpan (Qr)
		85-90	red sandstone
100	23-6434	0-20	fine sand (Qe over Qor)
		20-55	clay (Qhkl)
		55-83	gravel (Qhkf)
		screened 69-82, yield 226 gpm	
101	23-6433	0-18	sand, boulders (Qe over Qor)
		18-65	clay (Qhkl)
		65-85	sand, gravel (Qhkf)
		screened 72-88, yield 89 gpm	
102	23-1260	log by Frank Markewicz, NJGS, abbreviated here	
		0-21	tan fine-to-coarse sand and clay (Qor over Qhkl)
		21-36	light gray silty clay (Qhkl)
		36-53	pale red silty clay (Qhkl)
		53-60	pale red silt (Qhkl)
		60-69	pale red silt and gravel (Qhkl over Qhkf)
		69-77	gray coarse sand and pebbles (Qhkf)
		77-82	pale red fine-to-coarse sand with scattered pebbles (Qhkf)
		82-96	dusky red micaceous sandstone
103	23-1451	0-16	gray to brown clay with a little sand (Qst)
		16-17	coarse sand with a clay binder (Qst)
		17-27	gray clay (Qhkl)
		27-52	reddish brown clay (Qhkl)
		52-62	hardpan (Qr)
		62-64	sand and gravel with clay binder (Qr)
		64-79	hardpan (Qr)
		79-89	red sandstone
104	23-1971	0-12	brown clay (Qor)
		12-17	brown clay, gritty (Qor)
		17-34	gray clay (Qhkl)
		34-65	brown clay (Qhkl)
		65-77	brown clay, livery (Qhkl)
		77-87	small medium and large gravel with some fine and coarse sand, making water (Qhkf)

		87-102	red hardpan (Qr)
		102-106	red rock
		screened 77-87, yield 123 gpm	
105	23-7381	0-12	red hardpan (Qr)
		12-120	red sandstone
106	23-4442	0-30	sandy clay, sand (Qhk)
		30-88	sand, gravel (Qhkf)
		88-475	sandstone
107	23-6058	0-4	backfill
		4-30	gray clay (Qr)
		30-43	red clay (Qb or Qr)
		43-175	red sandstone
108	23-7908	0-28	brown sand (Qst over Qhk)
		28-44	red sand (Qhk)
		44-50	red hardpan (Qr)
		50-120	red shale
109	23-878	0-5	black loam (fill or Qst)
		5-15	sand (Qst)
		15-38	stony hardpan (Qr)
		38-122	red sandstone
110	23-4446	0-32	thick white clay (Qhkl)
		32-34	clean gravel (Qr or Qhkf)
		34-50	red rock
111	23-5838	0-10	clay (Qal over Qhkl)
		10-20	red clay (Qhkl)
		20-348	red rock
112	23-5940	0-10	hardpan (Qhk)
		10-33	red shale (Qr?)
		33-346	red rock
113	23-5939	0-11	hardpan (Qhk)
		11-33	red shale (Qr?)
		33-348	red rock
114	23-6267	0-40	stony hardpan (Qor over Qhk)
		40-81	sandy soil with some boulders (Qhk over Qic)
		81-252	sandstone
115	23-6345	0-49	fine sand and boulders (Qic over Qr)
		49-171	red rock
116	23-4284	0-30	boulders (Qr)
		30-76	hardpan (Qr)
		76-167	red rock
117	23-838	0-55	started in clay, then hit hardpan (Qr)
		55-268	red sandstone
118	23-2471	0-52	clay over sand and gravel (Qr over Qsp)
		52-150	red sandstone

119	23-1664	0-5	fill
		5-14	sandy red clay (Qe over Qr)
		14-33	hardpan with some coarse sand (Qr)
		33-35	rock, soft sandstone
		35-54	rock, hard sandstone
120	23-1672	0-10	yellow clay, sand and gravel (Qe over Qr)
		10-15	brown clay, sand and gravel (Qr)
		15-25	red hardpan, sand and gravel (Qr)
		25-53	red till, sand and gravel (Qr)
		53-77	red sandy clay (Qr or Qsp)
		77-79	red till (Qr)
		79-83	red sandy clay (Qr or Qsp)
		83-93	red sandy clay, not as much clay as previous (Qsp or weathered rock)
		93-105	red sand and clay (Qsp or weathered rock)
		105-113	sandy red clay, drills hard (Qsp or weathered rock)
		113-128	red sand and clay (Qsp or weathered rock)
		128-138	sand, quartz, and some clay (Qsp or weathered rock)
		138-401	red and brown shale and sandstone
121	23-5133	0-61	hardpan (Qr)
		61-500	red shale
122	23-4196	0-31	hardpan (Qhk)
		31-36	boulders, sand (Qhk or Qr)
		36-248	red rock
123	23-3807	0-18	clay (Qal over Qhkl)
		18-27	sand (Qhk or Qr)
		27-300	red rock and shales
124	23-7143	abbreviated log	
		0-5	fill--brown fine sand, little silt, trace brick and gravel
		5-12	brown medium-to-fine sand, little silt, hard packed (Qr)
		12-23	red brown coarse-to-fine sand, some silt, little medium-to-fine gravel (Qr)
125	23-2906	0-3	black muck (Qal)
		3-30	stony hardpan (Qr)
		30-33	gravel, some water (Qr)
		33-114	sandstone
126	23-4674	0-51	sand and gravel (Qhk)
		51-142	red rock
127	23-6320	0-38	stony sand and hardpan (Qic)
		38-102	soft red sandstone
128	23-2099	0-22	soft clay (Qhkl)
		22-40	sand and coarse gravel (Qtn)
		40-85	red rock
129	23-8004	0-5	clay (Qr)
		5-36	red rock
		36-205	red sandstone
130	23-501	0-10	sandy clay (Qr)
		10-16	coarse sand (Qr or weathered sandstone)
		16-25	fine sand (Qr or weathered sandstone)

		25-34	red sand (Qr or weathered sandstone)
		34-110	red sandstone
131	23-5977	0-25	sand, clay (Qic)
		25-31	white sandstone, coarse
		31-150	white and red sandstone
		at 150	trap rock
132	23-4689	0-20	sand (Qr)
		20-35	large gravel (Qr)
		35-38	clay (Qr)
		38-100	white sandstone
		100-140	trap mixed with white sandstone
133	23-6767	0-3	dirt (Qry)
		3-1205	trap rock
134	N 23-44-322	0-4	black muck and roots (Qs)
		4-19	stiff, reddish brown clay (Qhkl)
		19-27	brown clay, sand and gravel (Qr)
		27-47	reddish brown clay, sand and fine gravel (Qr)
		47-594	red sandstone
135	N 23-44-213	0-35	clay and silt, very hard white clay at base, no gravel (Qhkl over Qr)
136	23-5860	0-5	brown sandy hardpan (Qhk)
		5-30	brown sand, wet (Qhk)
		30-35	soft red shale
		35-53	soft red sandstone
		53-120	hard red sandstone
137	23-7297	0-14	bouldery dirt (Qhk)
		14-48	sandy soil (Qhk)
		48-60	red hardpan (Qr)
		60-125	red sandstone
138	23-7335	0-40	sandy soil with some boulders (Qic)
		40-96	sandy hardpan (Qic or Qr)
		96-174	red shale with some streaks of sandstone
139	23-7844	0-35	light brown sand (Qhk)
		35-40	pea gravel (Qhk)
		40-45	red hardpan (Qr)
		45-68	red shale
		68-205	sandstone and shale
140	23-1063	0-64	drilled by another driller (probably sand, Qhk)
		64-76	fine sand (Qhk)
		76-102	red sandstone
141	23-6873	0-63	sand and gravel (Qic over Qr)
		63-200	argillite
142	23-6818	0-45	brown soil with boulders (Qhk)
		45-73	red hardpan (Qr)
		73-130	red sandstone
143	23-971	0-33	glacial fill (Qr)

		33-82	red rock
144	23-5521	0-26	clay overburden (Qr)
		26-145	red sandstone
145	23-1446	0-24	sand hardpan with stones (Qr)
		24-75	red sandstone
146	23-4108	0-5	sand and gravel (Qic)
		5-7	gravel and sand (Qic)
		7-9	boulders, clay, gravel (Qic)
		9-27	gravel streaks, sand and clay (Qic)
		27-31	gravel (Qic)
		31-35	clay mixed with gravel (Qic)
		35-38	coarse gravel, clay and cobbles (Qic)
		38-42	gravel and clay (Qic)
		42-43	clay and gravel (Qic)
		43-364	shale and sand rock
147	23-1497	0-15	stony hardpan (Qic)
		15-24	sand (Qic)
		24-65	hard red sandstone
		65-102	red shale
148	23-7788	0-50	red hardpan and soft rock (Qr)
		50-160	red rock
149	23-3127	0-4	sandy overburden (Qr)
		4-35	sand (Qr)
		35-100	red sandstone
150	23-5228	0-28	overburden (Qr)
		28-500	red shale and sandstone
151	23-5590	0-30	hardpan, boulders (Qr)
		30-50	shale
		50-250	red rock
152	23-5879	0-11	sand (Qr)
		11-23	clay hardpan (Qr)
		23-33	hardpan--red sandstone (Qr over bedrock)
		33-125	red sandstone
153	23-3034	0-9	brown sandy hardpan (Qr)
		9-37	soft red shale
		37-130	hard red shale
154	23-6831	0-6	clay (Qr)
		6-51	sand (Qr or Qsp)
		51-200	red rock
155	23-927	0-12	sand (Qr)
		12-24	hardpan (Qr)
		24-36	sand with some water (Qsp)
		36-72	red sandstone
156	23-7828	0-9	sandy soil (Qr)
		9-30	red hardpan (Qr)
		30-102	red shale

157	23-6642	0-12	sand (Qr)
		12-19	fine sand and fine gravel (Qr)
		19-96	red shale, red sandstone
158	23-4795	0-39	unconsolidated overburden composed of coarse sand and boulders (Qic over Qr)
		39-59	red clay (Qr)
		59-200	red sandstone
159	23-5520	0-15	sand (Qic)
		15-25	red clay (Qic)
		25-145	red sandstone
160	23-7662	0-8	red hardpan (Qr)
		8-180	red sandstone
161	23-7107	0-16	stony hardpan (Qr)
		16-48	red sandy hardpan (Qr)
		48-107	red sandstone
162	23-7099	0-25	hardpan with boulders (Qr)
		25-54	sand and gravel with some water (Qr or Qsp)
		54-120	red sandstone
163	23-153	0-35	dirt and boulders (Qr)
		35-82	sand and gravel (Qsp)
		82-88	hardpan (Qb?)
		88-185	red rock
164	23-4248	0-45	gray clay (Qhkl)
		45-210	red rock
165	23-4250	0-45	gray clay (Qhkl)
		45-210	red rock
166	23-3259	0-23	sand and gravel (Qor)
		23-36	hardpan (Qhkl or Qr)
		36-171	red rock
167	23-7902	0-20	red brown medium-to-fine sand, some gravel (Qor)
168	23-7905	0-5	gray medium-to-fine sand, some silt (Qor)
		5-7	brown medium-to-fine sand (Qor)
		7-13	brown medium-to-coarse sand (Qor)
		13-17	red brown clay (Qhkl)
169	23-4332	0-30	clay (Qs over Qhkl)
		30-80	sand (Qhkf)
		80-140	gravel (Qhkf)
		140-201	rock
170	23-6186	0-22	black mud (Qs)
		22-54	red clay (Qhkl)
		54-60	sand (Qr or Qhkf)
		60-530	red rock
171	23-6016	0-18	clay (Qs)
		18-58	red clay (Qhkl)
		58-65	boulders (Qr or Qhkf)
		65-500	red rock

172	23-4318	0-62	clay, sand, hardpan (Qhkl over Qhkf over Qr)
		62-150	red rock
173	23-4285	0-10	muck (Qs)
		10-30	hardpan (Qhkl)
		30-90	clay (Qhkl)
		90-450	red rock
174	23-321	0-70	sand (Qhkl or Qhkf)
		70-145	red shale
175	23-300	0-76	sand (Qhkl or Qhkf)
		76-150	red shale
176	23-984	0-12	sand hardpan (Qr)
		12-50	sand (Qsp)
		50-60	gravel (Qsp)
		cased to 60 feet, yield 25 gpm	
177	23-2590	0-30	sand (Qor)
		30-80	clay (Qhkl)
		80-88	gravel (Qr or Qhkf)
		88-180	red rock
178	23-3699	log by Frank Markewicz, NJGS	
		0-50	brownish red sandy silty overburden with boulders (Qor over Qr)
		50-320	siltstone and sandstone
179	23-2592	0-25	sand, clay, gravel (Qr)
		25-125	rock
180	23-7210	0-12	red hardpan (Qr)
		12-92	soft red rock
		92-412	red shale and sandstone
181	23-4438	0-19	sand and gravel (Qr)
		19-25	large gravel and small boulders (Qr)
		25-78	red rock
182	23-2107	0-38	hardpan with lots of small boulders (Qr)
		38-79	reddish trap rock
		79-130	gray trap rock
183	23-222	0-21	earth (Qry)
		21-105	diabase
184	23-7950	0-6	overburden (Qry)
		6-44	broken trap rock to solid trap
		44-205	mixture of various conglomerate rock
185	NJGS files		
	0-2	topsoil and loam (af)	
	boring by P. J. Healey, Inc.	2-7	meadow marsh and sand (Qm)
		7-11	gray clay and sand (Qm or Qhkl)
		11-23	brown clay and thin layers of sand (Qhkl)
		23-34	red clay (Qhkl)
		34-40	red silty sand (Qhkl)
		40-50	red sand and coarse gravel (Qhkf)
186	NJGS files	0-3	cinders, brown sand and gravel fill
	boring by P. J. Healey, Inc.	3-13	brown sand (Qtn)
		13-15	gray sand (Qtn)

187	NJGS files	0-1	topsoil
	boring by P. J.	1-2	brown clay, sand, gravel, and boulders (Qr)
	Healey, Inc.	2-25	red sand, gravel, clay, boulders (Qr)
188	NJGS files	0-7	medium-to-fine brown sand with trace of gravel (Qr)
	boring by P. J.	7-25	medium-to-fine reddish brown sand with shale fragments
	Healey, Inc.		and trace of gravel and clay (Qr)
189	NJGS files		abbreviated log
	boring by P. J.	0-6	fine-to-coarse brown, gray, white sand and gravel (Qst)
	Healey, Inc.	6-22	brown silt with some fine sand (Qtnl)
		22-34	fine brown silty sand (Qtnl or Qr)
		34-35	fine-to-medium multicolored sand (Qr)
		35-36	soft red and green sandstone

[1]Numbers of the form 23-xxxx or 26-xxxx are well permit numbers issued by the N.J. Department of Environmental Protection, Bureau of Water Allocation. The notation “BWA files” followed by a number of the form 23-xx-xxx indicates N. J. Atlas Sheet grid locations of logs in the Bureau of Water Allocation files that do not have permit numbers. Notations of the form N 23-44-213 are N. J. Atlas Sheet grid locations of entries in the permanent note collection of the N. J. Geological Survey.

[2]Depth in feet below land surface.

[3]Inferred map units and comments by author in parentheses. All descriptions are reproduced as they appear in the original source, except for minor format, punctuation, and spelling changes. Logs identified as abbreviated have been condensed for brevity. Some bedrock descriptions have been condensed; these are not identified as abbreviated. The notation “NR” indicates “not reported”. For wells completed in surficial materials, the screened interval and reported yield (in gallons per minute, gpm) are reported beneath the log. Map units are inferred from the known extent of materials at the surface and from known depositional settings, in addition to driller’s descriptions.